iv. Beam Absorber

The dump absorber will be approximately 5.2 m long and composed of three sections. The first and most critical will be composed of a special carbon-carbon material (C-C) having extremely high thermal shock resistance. This section will be about 0.5 m long and will be within the vacuum chamber. The aborted beam will exit the circulating beam tube through an opening into a side parallel vacuum chamber. This side chamber, while open to the main beam pipe, will be differentially pumped along its length and will have the carbon-carbon absorber face exposed at the end (refer to Fig. 6-4). This arrangement will eliminate the necessity of a vacuum window being the first element the ejected beam encounters. After passing through the 0.5 m of the C-C absorber, the beam will lose sufficient energy so that a high strength stainless (17-7PH) vacuum window can withstand the thermal stress of its passage to the next absorber. This second absorber will be a block of ordinary graphite and will be about 2.7 m long. The graphite block will be contained in a sealed enclosure containing nitrogen at one atmosphere to preclude the possibility of ignition due to the thermal load of the beam absorption, and will be capped top and bottom by steel shielding slabs. The final absorber, 2 m of steel, will be located downstream of the graphite section. In addition to the absorber structure, the adjacent circulating beam tube downstream of the C-C section will also be surrounded by steel.

The entire core section will be surrounded by 15 cm (6 in.) of steel shielding on the top, bottom and both sides, with an additional 15 cm (6 in.) of marble on the sides to aid in personnel shielding from the activated steel and graphite components. The removable blocks of shielding (steel and marble) on the aisle side will be mounted on rollers to afford quick access to the core. Figure 6-11 shows some details of the dump/shielding structure. The core itself can be removed from the beam tube for vacuum leak checking or repair of the integral bakeout heater. Because of the small core beam tube (46×42 mm inside), some horizontal position adjustments are thought to be necessary to maximize the available circulating beam tube aperture. Consequently, the entire dump will be positioned on an adjustable table allowing a manual (not remote) adjustment of ±1 cm horizontally. Dial indicators at both ends will monitor the absolute position of the assembly. Lateral movement of the dump assembly will require re-programming of the kicker current as the deflection angle will be altered; therefore remote motion will not be allowed and the positioning devices will be lockable. The off-center configuration of the core can also be ameliorated by the use of a bump magnet mentioned earlier. Inclusion of a bump magnet will also need to be included in the voltage

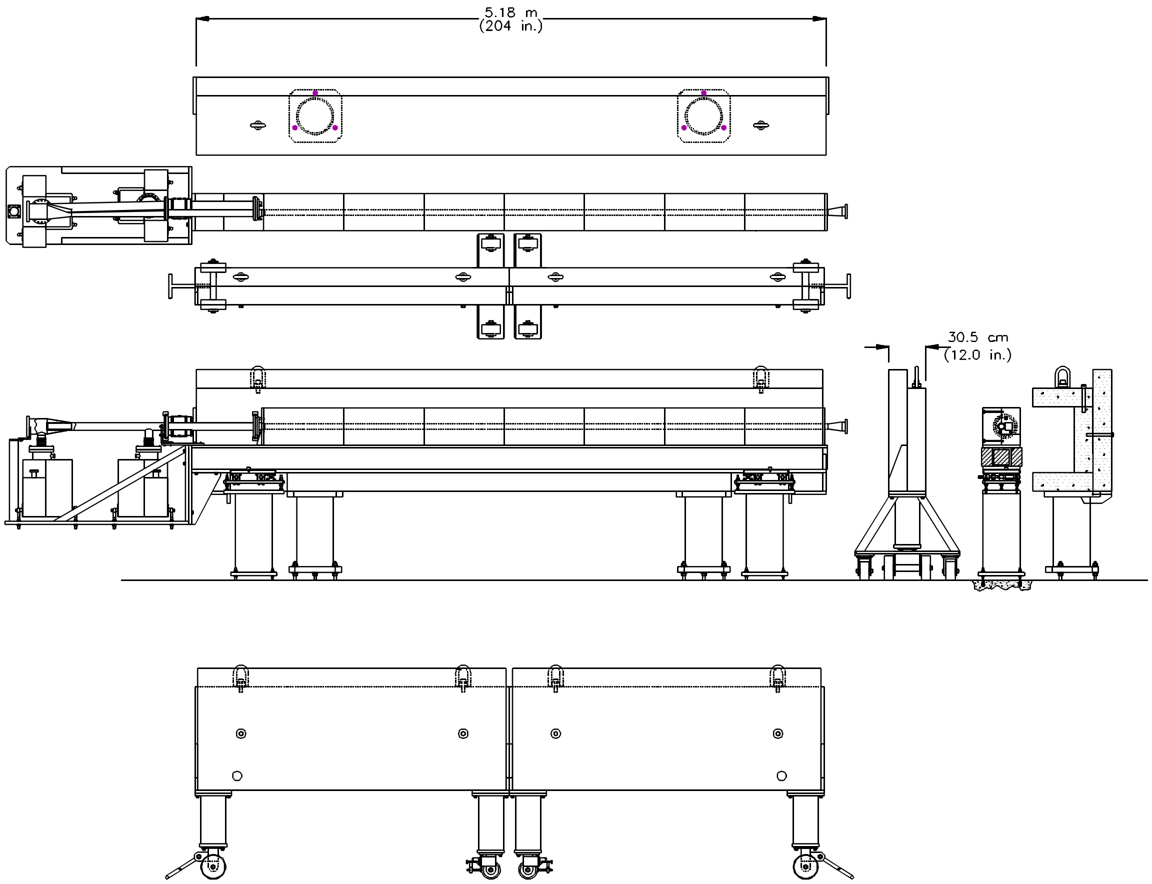

Fig. 6-11. Beam absorber and shielding.

programming of the abort waveform to ensure that the ejected beam impinges on the proper area of the C-C absorber.

The C-C absorber section will be contained in a thin wall stainless steel chamber with chain clamp flanges at either end for quick removal. This arrangement will afford ease of C-C block replacement with minimum personnel exposure (ALARA). The thin side walls are designed to bend inward against the C-C material under vacuum to increase thermal contact and subsequent convective cooling to the outside air. Just downstream of the C-C section will be a small 2.5 cm (1 in.) air gap for insertion of an array of thermocouples to monitor the integrity of the carbon-carbon absorber block.

The entire dump vacuum system will be bakeable. This will be accomplished by standard fiberglass insulated heater tapes in areas outside of the core and by a special Kapton-wire heater (wrapped with fiberglass tape) around the oval tube through the core. No forced cooling of the dump core will be necessary for beams up to 4 times the design intensity dumped once per hour.

The external (earth) shielding in the dump area has been analyzed with respect to groundwater activation, sky shine, air activation and muon radiation. Based on the analysis for ~2400 annual dumps/ring of gold beams at top energy and 4× design intensity, an additional 1.5 m (5 ft) of earth will be added atop the nominal berm thickness at the dump locations to meet the sky shine criteria of 1 mrem/yr at the site boundary. An impervious liner will be placed just below the surface of the berm to prevent infiltration of rainwater into the earth shielding, and groundwater monitoring wells will also be installed in these areas.